

\*1128  
1983  
Record  
c.1

DEPARTMENT OF ENERGY

Bonneville Power Administration

Record of Decision  
The Expanded Residential Weatherization Program

AGENCY: Bonneville Power Administration (BPA), DOE.

ACTION: Record of Decision.

SUMMARY: The Administrator of the Bonneville Power Administration has decided to expand the present BPA Residential Weatherization Program to make "house tightening" measures--storm windows, other window treatments conserving energy, wall insulation, weatherstripping, caulking, and door treatments such as thermal pane replacements--available to all electrically heated homes in the BPA service area otherwise eligible for the program, and to adopt mitigation strategies to lessen the risk of adverse human health effects. The mitigation strategies include: (1) giving program participants (residents) information on indoor air pollutant sources and practical steps for reducing concentrations; (2) giving program participants options for having their homes monitored for radon concentrations; and (3) partially subsidizing the installation of a proven mitigation device, if radon concentrations exceed 5 picoCuries per liter, the action level selected by BPA.

This is the "preferred alternative" analyzed in BPA's Final Environmental Impact Statement for The Expanded Residential Weatherization Program, issued August 10, 1984 (DOE/EIS-0095F).

Five alternatives were analyzed and compared in reaching the above decision: (1) no action, or continuation of the present Residential Weatherization Program, which limits the availability of house tightening measures to dwellings devoid of possible major sources of radon, formaldehyde, and combustion by-products; (2) the proposed action, offering house tightening measures to all electrically heated homes in the BPA service area; (3) the preferred alternative, which offers house tightening measures to all electrically heated homes in the service area plus mitigates the increment of indoor air pollution by giving information on indoor air pollutants, providing options for radon monitoring and subsidized air-to-air heat exchangers to program participants; (4) the environmentally preferred alternative, which entails tightening all electrically heated homes in the service area plus fully mitigating the increment of indoor air pollution by installing air-to-air heat exchangers in each participating home; and

P BPA c1ROD OCLC  
BPA1128 1984  
The expanded residential  
weatherization program : record  
United States. Bonneville Power

(5) the delayed action alternative, which retains the restrictions of the present program for another 3 to 5 years, to see if ongoing research throughout the country leads to a better understanding of indoor air pollution and associated health risks.

The following decision factors entered into the decision to implement the preferred alternative: (1) health risk, the increment of risk to human health from house tightening measures; (2) energy savings, the amount of electric power acquired under each alternative; (3) cost, the price of each alternative; (4) public comment the views of those responding to the Draft Environmental Impact Statement; (5) statutory mission, BPA's obligations under the Pacific Northwest Electric Power Planning and Conservation Act including the obligation to give first priority to energy conservation; (6) Northwest Conservation and Electric Power Plan, consistency with the plan of the Northwest Power Planning Council; (7) choice, the voluntary nature of participation in the program by residents, and the effect of their actions on indoor air pollutant concentrations in their dwellings; (8) self-help, the ability of occupants to reduce indoor air pollution by avoiding known pollution sources or exercising other options based on information received; (9) uncertainty, the recent recognition of the problem of indoor air pollution and lack of conclusive information on related health effects; (10) behavioral variability that differences in residents' ways of life contribute to differences in indoor air pollution; (11) home variability, that indoor air pollution varies across dwellings because they differ in construction practices, structure, air volume, pollutant sources, and emission rates of these sources; (12) environmental policy, the protection of the quality of the human environment, taking into account the effectiveness of alternative means for reducing risks of ill-health, and the possible need of acquiring electric generating plants, in lieu of conservation, which would consume land and water resources; (13) administrative practicality, the ease and fairness of administering a regional program in cooperation with Pacific Northwest utilities, States, and other entities; (14) intergovernmental relations, minimizing conflict over differences in conservation programs with Federal, State, and local agencies; (15) BPA's role, the agency's limited ability to regulate individual behavior in private homes; and (16) employment, providing jobs.

The Administrator is using his discretionary authority in deciding to implement the preferred alternative rather than any of the other four alternatives considered. In reaching this decision, a series of policy judgments were made, based on the foregoing decision factors, to develop a risk management strategy that balances the uncertain incremental risk of ill health from house tightening with the costs of reducing that risk while obtaining most of the cost-effective potential energy savings which are available from home weatherization.

The preferred alternative is chosen over the other alternatives because:

- by offering all tightening measures to all homes, more potential energy savings from home weatherization can be obtained, thereby fulfilling the mandates of Congress and recommendations of the Northwest Power Planning Council for giving first priority to cost-effective conservation before acquiring other forms of electric energy resources;
- by offering to monitor for radon, the agency is taking steps to identify the presence of a pollutant in individual homes which can present a serious health hazard, accounting for almost half of the health risks from the indoor air pollutants reviewed for this record of decision; radon monitoring devices are readily available, practical to use in a regional program, inexpensive, and give relatively reliable results;
- by offering radon monitoring to program participants, there will be opportunity to identify high risk homes which can then be matched with appropriate mitigation; mitigation in homes with high radon concentrations will reduce the risk of cancer from radon exposure for individuals living in these dwellings, and will eliminate their incremental health risk from house tightening; therefore, the expenditures of funds for radon monitoring is warranted;
- by paying for mitigation in high risk homes, BPA's mitigation expenditures (about 8 percent of the funds needed for program expansion) will directly benefit those program participants at high risk; although these participants are few in number (about 5 percent of all potential program participants), they carry a disproportionate share of the regional health risk from radon exposure, and therefore warrant the expenditures of funds for radon mitigation;
- by giving mitigation only to high risk homes, rather than all homes participating in the program, energy savings will be increased and program costs reduced while attaining a level of risk likely to be accepted by program participants; and
- because public comments on the Draft Environmental Impact Statement indicated strong support for informing program participants about the relationship between house tightening and indoor air quality, and letting them make their own choices regarding house tightening and mitigation.

The decision to implement the preferred alternative means that no special steps will be taken to monitor and mitigate for formaldehyde and combustion by-products, other than informing program participants about these indoor pollutants. The factors contributing to this policy judgment are:

- formaldehyde is a very minor contributor to the increment of cancer risk from house tightening;
- mitigation devices are not warranted for formaldehyde because of its transient nature (as home products containing formaldehyde age, the off-gassing of this chemical decreases);
- information is the most effective means for mitigating health effects from formaldehyde, which include irritation to skin, eyes, mucous membranes and the respiratory tract, because residents are likely to be aware of recently installed furnishings containing formaldehyde (e.g., kitchen cabinets);
- the uncertainty associated with the effectiveness of available techniques for reducing formaldehyde concentrations does not warrant the expense of paying for the mitigation, or expending energy to operate mitigation devices;
- because combustion by-products are present in a home directly as a result of human activities such as smoking or operating wood-stoves, and because combustion can easily be detected through the senses, it was decided that the most effective way of mitigating for the health effects of house tightening is to inform residents about how to recognize combustion pollutants and correct for them, thereby letting them make their own choices regarding the incremental risks of ill-health from combustion in a tightened house;
- of the various combustion by-products, benzo-a-pyrene was shown to contribute over half of the risk increment from house tightening; however, no special monitoring was incorporated into the preferred alternative for combustion by-products in general, or benzo-a-pyrene in particular, because the technology for such monitoring is neither well-developed nor readily available.

In summary, the expanded weatherization program constitutes a risk management strategy which will lead to most of the potential energy savings possible from home weatherization at a cost-effective price. It allows for the matching of homes at high risk from radon gas with appropriate mitigation at an acceptable cost, while keeping risk at a minimum level. It gives information to program participants regarding pollutants which they can recognize and control themselves if they so choose, thereby limiting BPA's intrusion into areas normally left to individual choice.

All practical means will be adopted to avoid or minimize environmental harm from the alternative selected. In 1983, BPA entered into a Programmatic Memorandum of Agreement with the Advisory Council for Historic Preservation and the State Historic Preservation Officers of the States served by the agency, to avoid adverse effects to properties on or eligible for the National Register of Historic Places. This agreement is standard policy for all BPA conservation programs, including this action. All conservation programs also have oversight and compliance features to insure that program implementors meet all requirements for avoiding or minimizing adverse effects on the quality of the human environment. A standard environmental monitoring program is not applicable to residential conservation programs. However, the results of research on indoor air quality effects and mitigation being conducted by BPA, and other entities across the Nation, will be reviewed regularly to determine whether adjustments need to be made in the preferred alternative to avoid or minimize environmental harm.

#### SUPPLEMENTARY INFORMATION:

##### Background:

The Revised Environmental Assessment for the current Residential Weatherization Program, which went into effect in September 1981, showed that occupants of dwellings would be exposed to increased concentrations of indoor air pollutants as a result of installing conservation measures which reduce air infiltration (i.e., caulking, storm windows and doors, weatherstripping, and switchplate and outlet box gaskets). This would, in turn, increase occupants' risks of adverse health effects, including the risk of lung cancer, and the risk of more headaches, eye, nose, and throat irritation.

To avoid these effects, the agency developed and implemented a limited program. Of the homes eligible for the program, only those which met the following criteria were allowed to receive house tightening measures: (1) presence of a fully ventilated crawlspace, as specified by the 1979 Uniform Building Code; (2) absence of woodstoves, unvented combustion appliances, and urea foam formaldehyde insulation; and (3) domestic water supplied from surface water or municipal water system. Also, no tightening measures were to be installed in mobile homes, which tend to have higher concentrations of formaldehyde than other types of homes. The crawlspace requirement allows for ventilation of radon gas, which enters dwellings mainly from the soils on which they are built. The other requirements reduce the probability that dwellings with major sources of indoor air pollutants, especially combustion by-products and formaldehyde, will receive tightening measures financed by BPA. These homes, however, may still receive nontightening measures such as ceiling insulation and clock thermostats.

Brochures on indoor air quality are distributed to all present program participants, on the assumption that once informed about indoor air quality, some people may take steps to upgrade their indoor air quality. Since indoor air quality is extensively affected by consumer practices and household activities, BPA believes public education is one way of enhancing indoor air quality in dwellings.

Upon implementation of the limited program, the agency began preparation of a Draft Environmental Impact Statement (EIS) which examined more thoroughly the effects of 3 alternatives and 11 mitigation strategies for offering tightening measures to electrically heated dwellings in the agency's service territory. The Draft EIS was issued in August 1983. The Final EIS, issued in August 1984, assessed 5 alternatives and 11 mitigation strategies, reflecting public comments received on the Draft EIS.

The Environmental Effects of Alternatives Considered in the Final Environmental Impact Statement:

1. No action (continuing the present BPA Residential Weatherization Program).

Increase in annual risk of cancer: 0.047 per 100,000 persons above a baseline of 5.3 cancers per 100,000 persons because house tightening increases existing levels of indoor air pollutants, even in homes meeting the criteria for receiving house tightening measures.

Range of uncertainty for estimated risk increase: 0.0074 to 0.39 per 100,000 persons per year. Range of uncertainty for baseline: 1.78 to 35.05 per 100,000 persons per year.

Increase in annual cancer risk by pollutant:

Benzo-a-pyrene: 0.04 per 100,000 above a baseline of 2.6 per 100,000;

Radon: 0.004 per 100,000 above a baseline of 2.5 per 100,000 persons;

Formaldehyde: 0.003 per 100,000 above a baseline of 0.2 per 100,000

Homes eligible for tightening measures: 327,000 dwellings

Homes eligible for non-tightening measures: 1,209,000 dwellings

Energy saved: 191 megawatts (1981 estimate)

Energy savings foregone because tightening measures applicable to only 30 percent of electrically heated homes: 105.7 average annual megawatts.

Cost: \$550 million or a levelized cost of 25.9 mills per kilowatt hour (1983 estimate).

Land and water resources foregone since a generating plant may have to be built sooner to cover foregone energy savings:  
2,535 acres of land; 134,000 acre-feet of water.

2. The proposed action (offering tightening measures to all electrically heated homes in the BPA service area).

Increase in risk of cancer: 0.79 per 100,000 people per year above the no action level.

Range of uncertainty for estimated annual risk increase: 0.102 to 7.95 cancers per 100,000 people.

Increase in annual cancer risk by pollutant:

Benzo-a-pyrene: 0.43 per 100,000 persons above no action;

Radon: 0.32 per 100,000 persons above no action;

Formaldehyde: 0.04 per 100,000 above no action.

Homes in program assuming 85 percent participation rate:  
1,209,000 dwellings.

Energy saved: 105.7 average annual megawatts above no action.

Energy foregone: none because all homes participating in program will be eligible for tightening measures.

Cost: \$843.9 to \$1569.3 million above the no action level, or a levelized cost of 13.4 to 23.3 mills per kilowatt hour (kWh).

Land and water resources foregone: none in comparison to no action.

3. The preferred alternative (offering tightening measures to all electrically heated homes in the BPA service area plus mitigating the increment in indoor air pollution by giving information and options for monitoring and air-to-air heat exchangers to program participants).

Increase in risk of cancer: 0.78 per 100,000 people per year above the no action level.

Range of uncertainty for estimated risk increase: 0.092 to 7.95 per 100,000 people per year.

Increase in annual cancer rate by pollutant:

Benzo-a-pyrene: slightly less than proposed action;

Radon: 0.31 per 100,000 people above no action;

Formaldehyde: slightly less than proposed action

Homes in program: same as proposed action.

Homes expected to exceed action level for radon and be eligible for proven mitigation devices: about 60,500 dwellings. (The U.S. Census Bureau estimates that in 1984 the average household size is 2.71 persons.)

Energy saved: 104.5 average annual megawatts above no action.

Energy foregone: 1.2 average annual megawatts for operation of mitigation devices.

Cost: \$920.5 to \$1699.3 million above no action, or a levelized cost of 14.3 to 25.9 mills per kWh.

Land and water resources foregone: almost none in comparison to no action.

SPECIAL NOTE: The risk assessment model which was used to estimate the health effects of the various alternatives, discussed in detail in the Final EIS, contains the assumption that all homes have the same average concentrations of indoor air pollutants, including radon. This means that the residents of these homes have the same average risks of ill-health from indoor air pollutants, and the same average incremental risk from house tightening. In reality, a relatively small percentage (about 4 to 6 percent) of the 1,209,000 homes likely to participate in the program are expected to have radon concentrations which exceed BPA's action level of 5 picoCuries per liter. These homes carry a disproportionate share of the incremental regional risk of cancer from house tightening. The monitoring and mitigation risk management strategy of the preferred alternative concentrates precisely on those homes which are at high risk from radon. Therefore, the overall health effects of the risk management strategy can reasonably be expected to be considerably greater than those estimated by the model, which assumes that the risk reduction effect of mitigation is spread evenly across all homes (see section 7 for more discussion).

As radon monitoring data becomes available from implementation of the preferred alternative, BPA will be able to prepare a more realistic estimate of the efficacy of its monitoring and mitigation strategy for reducing health risks from house tightening. This

strategy accounts for about 8 percent of the costs of the preferred alternative, or about 1 mill per kWh of the levelized cost. BPA takes the position that the monitoring and mitigation strategy, which will facilitate a comprehensive residential weatherization program by assisting program participants at high risk from radon exposure, warrants the additional expenditure of funds.

4. The environmentally preferred alternative (offering tightening measures to all electrically heated homes in the BPA service area, plus mitigating the indoor air pollution increment by installing air-to-air heat exchangers in each home) considered to be environmentally preferable because it yields some additional energy savings without increasing risks of ill health.

Increase in risk of cancer: similar to no action.

Homes in program: similar to proposed action.

Energy saved: 87.4 average annual megawatts above no action.

Energy savings foregone: 18.3 average annual megawatts for operation of mitigation devices.

Cost: \$1409.1 to \$2956.6 million above no action or a levelized cost of 19.8 to 50.6 mills per kWh.

Land and water resources foregone: 183 to 2,104 acres of land and 111,000 to 7.1 million acre-feet of water.

5. The delayed action alternative (retaining the present program's restrictions until continuing research leads to a better understanding of indoor air pollution and associated health effects).

Increase in risk of cancer: same as no action until a new decision is made.

Homes in program: same as no action until a new decision is made.

Energy saved: same as no action until a new decision is made.

Energy savings foregone: same as no action until a new decision is made.

Cost: same as no action plus cost of any additional research which BPA chooses to incorporate into its present indoor air quality research program.

Land and water resources foregone: same as no action until a new decision is made.

### The Nature of the Decision:

The decision to select the preferred alternative consists of a series of policy judgments, using the decision factors listed in the summary. The decision will result in a strategy for managing risks which balances the incremental risk of ill health resulting from house tightening with the costs of reducing that risk while acquiring all available cost-effective electric energy savings from home weatherization. The Administrator exercises discretion in choosing the preferred alternative by making a judgment of the best course for pursuing residential energy conservation. In making this judgment, the Administrator determines the appropriate expenditure of Federal funds in the execution of a Federal action, The Expanded Residential Weatherization Program.

### Decisions Made and Underlying Reasoning:

#### 1. The decision to expand the present program.

BPA's five alternatives for expanding the current residential weatherization program present three different basic courses of action from which to choose. The proposed action, the preferred alternative, and the environmentally preferred alternative all expand the program in some way. The no action plan means continuing the program as is, without additional action. The delayed action alternative means postponing decisions until a future date. Essentially, the alternatives are to do something, do nothing, or postpone action. The paramount considerations in making this choice were the amount of energy savings to be acquired, the costs of the energy savings to be acquired, the potential increment of harmful health effects from conservation, and public preferences.

The acquisition of an additional 104.5 average annual energy savings from program expansion will aid the agency in assuring an adequate, efficient, economical, and reliable power supply in its service area, as stated by the Pacific Northwest Electric Power Planning and Conservation Act (the Act). This acquisition is also consistent with the Act's requirement that the agency give first priority to the acquisition of cost-effective conservation in assuring an adequate power supply. Finally, the expansion of the weatherization program is consistent with the Two-Year Action Plan of the Northwest Power Planning Council, which asks BPA to acquire cost-effective conservation by weatherizing the existing, electrically heated housing stock.

In deciding to acquire an additional 104.5 average annual megawatts of conservation, the Administrator took into account that the current surplus of electric energy resources is projected to continue through about 1991, after which additional resources may have to be in place to assure an adequate electric power system. To have

sufficient cost-effective conservation on hand for the projected future deficits, the agency must begin acquiring the resource now. Energy savings from the expanded weatherization program will occur incrementally, house by house, over 10 years of program operation before maximum conservation is reached.

The entire residential weatherization program, with the expansion described here, is estimated to have a levelized cost of between 21.6 and 25.8 mills per kilowatt-hour. These estimates are within the Northwest Power Planning Council's current cost effectiveness limit of 40 mills per kilowatt-hour.

The Pacific Northwest Electric Power Planning and Conservation Act requires the Administrator to examine the environmental costs and benefits of an action as well as its monetary costs when determining the cost-effectiveness. In the case of the preferred alternative, the Administrator determines that no environmental costs will result from program expansion. Therefore, there are no environmental costs to be incorporated into the cost-effectiveness calculations.

This determination evolves from the following considerations:

(1) The employment effects of expansion cannot be counted as an environmental benefit because these are already counted as program expenses for the labor to install conservation measures.

(2) The land and water resources effects are indirect effects of program expansion and would only become an environmental cost when generating plants, which directly affect these resources, are acquired. Such environmental costs would be estimated and applied to generating facilities when making a cost-effective determination for their acquisition.

(3) There is no way of quantifying, and therefore of pricing other effects attributable to the expanded program such as increased home comfort from weatherization.

(4) The increment in risk of ill-health, from house tightening, is the only environmental effect directly attributable to program expansion which is eligible for inclusion in cost-effectiveness calculations.

In reviewing the features of the expanded program and the economic procedures for pricing health risks, the Administrator makes the policy judgment that the environmental cost of the incremental risk of ill-health from the program will be taken into account by participants in the expanded program, and therefore has a value of zero. A central theme of the expanded program (see sections 4 and 5) consists of informing program participants about incremental health

risks from house-tightening, and offering them options for mitigation if they volunteer to proceed with house-tightening. Residents will have the opportunity to weigh the health risks from house-tightening against the value of the energy savings to be derived therefrom, in making their own voluntary decisions about the extent of their participation in the expanded program. Since quality of indoor air is largely affected by individual residence characteristics and by the habits and actions of residents, informed program participants are in the best position to judge the value of house-tightening to them, given their own health and indoor air quality situation. In this way program health risks become an internal part of the decisions to be made by program participants. When program participants decide to accept the health risks from house tightening, they must also accept the health costs. Therefore, these costs are not environmental costs to be included in cost-effectiveness determinations.

Although the foregoing determination, that the environmental costs of the preferred alternative are zero, may be disputed, it is clear that the wide uncertainty range of the health risk estimates would, if converted to dollars, produce cost values which are much less meaningful than a straightforward social policy consideration based on the number of human lives at risk from house tightening. The Administrator has fully considered these risks in the context of BPA's responsibility for public health and energy efficiency, and therefore has complied with section 4(e)(2) of the Pacific Northwest Electric Power Planning and Conservation Act. This section requires consideration of environmental costs when determining the cost-effectiveness of actions to save or acquire energy.

By choosing to expand the program the agency will, in the long run, keep down the costs of providing an economic and reliable power supply. If energy savings are not acquired through program expansion, the savings would have to be acquired through other forms of conservation, or through acquisition of additional power generation several years sooner than otherwise. Other forms of conservation and power generation are more costly than acquiring energy savings through expansion of the program.

The increased risks to public health from program expansion are not found to be of a sufficiently substantial nature to dissuade the Administrator from acquiring the energy savings that expansion is expected to yield. Several factors entered into this policy judgment. First, the increment of risk is relatively low when compared to risks which people are normally willing to accept. The incremental risk of cancer from the expanded program is similar to the risk of one person contracting cancer out of 100,000 who smoke 10 to 30 cigarettes over a lifetime, or the risk of one person having a fatal accident out of 100,000 who travel in a motor vehicle for 600 miles. Second, risk estimates for all the alternatives considered are highly uncertain because data are lacking on the distribution of indoor air pollutant

concentrations in the region's homes. To compensate for this lack of data, the assumptions about indoor air pollution, on which the risk estimates are based, were systematically varied to yield a range of health risk for each alternative. These risk ranges describe the uncertainty of the risk estimate. As a result of these uncertainties, the high end of the risk range for the no action alternative overlaps with the low end of the risk range for the preferred alternative. Third, the potential incremental health risks of the expanded program will be borne by participants who will benefit from the energy savings which house tightening yields. Fourth, means are available for reducing the risks to health which are expected to result from program expansion.

If the Administrator chose not to expand the program, the foregone conservation would probably have to be made up through construction of a generating facility several years sooner than otherwise, which would have its own environmental effects, including the certain loss of some land and water resources. In view of the uncertainties surrounding the increment of health risk from program expansion and program opportunities for mitigating that risk, the Administrator has decided to expand the program rather than incur the certain losses of natural resources because of the earlier need for more generation.

Public comments on the Draft EIS also influenced the decision to expand the program. Commentors indicated a strong preference for conserving energy through program expansion over delaying or not taking any action, and urged that program participants be allowed to choose whether to accept the increases in risk of ill health therefrom.

2. The decision to include all categories of homes in the expanded program.

This decision will allow all categories of electrically heated homes otherwise eligible for the program to receive house-tightening measures. This is not the case in the current program, where only certain types of homes (e.g., homes with fully ventilated crawlspaces) are eligible for these measures.

This decision is being made, among other reasons, because the increment of risks to health from house-tightening cannot be readily attributed to any particular house characteristic. Any or all of the following factors, which vary across dwellings, affect the concentrations of indoor air pollutants: geological characteristics of locale and the house lot, local climate, and very specific residence characteristics such as construction practices and materials, and dwelling volume. Factors such as these affect pollutant source strengths and daily pollutant emission rates which, in turn, affect indoor air quality. These factors, whose variability across homes is not known, may account more for the level of indoor air pollutant

concentrations in any particular home than do gross indicators of the possible presence of pollutants based on house type (e.g., homes with well-ventilated crawlspaces are presumed to have less radon than homes with basements).

In addition, there is virtually no empirical evidence to support a risk management strategy of not allowing certain types of homes to receive tightening measures. For example, to date, BPA's ongoing studies of radon in individual homes do not indicate a correspondence between house type and levels of radon concentration.

A risk management strategy of excluding certain types of homes from an expanded program also does not take into account the fact that behavioral variability, such as smoking, the operation of woodstoves, the use of household chemicals, and the purchase of products containing formaldehyde, can greatly affect indoor air quality and related health risks.

The decision to drop the present restrictions for indoor air quality is also premised on the following considerations. (1) More energy savings can be acquired by removing the restrictions, monitoring to identify high-risk homes, and then mitigating those with ventilation devices instead of mitigating by automatically excluding certain types of homes. (2) The program will be more practical to administer without having to evaluate each house for consistency with the restrictions. (3) The program will be less confusing and more equitable and fair to occupants of electrically heated homes if no otherwise eligible house type is excluded. (4) Public comments received on the Draft EIS gave strong support to including all categories of homes; there was virtually no support for continuing to exclude certain categories of homes. (5) Removal of present restrictions will make the expanded program more consistent with programs offered by other entities, thereby reducing conflict with Federal, State, and local agencies.

3. The decision to include all cost-effective tightening measures.

This decision entailed choosing those tightening measures with potentials for energy savings that are commensurate with the costs of purchasing and installing them. The current menu of technically proven tightening measures includes storm windows and doors, thermal pane replacement glass for windows and sliding doors, insulated entrance doors, caulking, weatherstripping, batt insulation, blown-in/loose-fill wall insulation, and outlet box and switchplate gaskets.

Of the measures on this list, blown-in wall insulation will be added to the expanded program. This measure was not offered under the current program because of possible problems from moisture becoming trapped in the insulation, and the difficulties of inspecting

the measure after it is installed to assure that it is yielding the expected energy savings. The agency's research on the moisture problem indicates that it is of negligible concern. To solve the inspection problem, the agency has developed specifications for appropriate installation, and has adjusted downward the energy savings expected to result from wall insulation. Even so, wall insulation remains cost effective.

Two measures on the above list are not cost effective, and therefore will be excluded from the expanded program. Because storm doors malfunction easily, they do not yield enough energy savings to compensate for their high capital costs. Switchplate and outlet box gaskets yield too little savings to be cost effective if paid labor is used to install them.

All the other measures listed above are being offered in the current program, and will be retained for the expanded program. The reasons which enter into this decision are: (1) By including all these measures, the energy savings from the expanded program can be maximized. (2) The measures are cost effective. (3) Inclusion of all cost-effective measures will make it easier to administer the program by increasing its acceptance; past experience indicates there is a reluctance to participate in programs which do not offer the full range of standard conservation measures including house tightening. (4) Inclusion of all the cost-effective measures will make the expanded program more consistent with the Northwest Conservation and Electric Power Plan, and programs offered by others, including Federal, State, and local agencies, and Pacific Northwest electric utilities. (5) Public comments received on the Draft EIS were supportive of these measures.

4. The decision to allow residents to make an informed choice about the extent of their participation in the expanded program.

The preferred alternative gives options to program participants which allow for individual circumstances and willingness to accept an incremental risk of ill-health. The exercise of these options is based on informed consent.

First, program participants will receive information on how to recognize the presence of indoor air pollutants, especially formaldehyde and combustion by-products, and the steps that can be taken to upgrade indoor air quality. Second, after being informed about indoor air quality, residents have several options for proceeding, based on their assessment of the risk. These include: declining the house-tightening measures; accepting house-tightening without radon monitoring; and accepting tightening with radon monitoring. Residents can choose to have their homes monitored for radon, a naturally occurring gas, either before or after the installation of house-tightening and other conservation measures. If the monitoring shows that a dwelling exceeds the action level of

5 picoCuries/liter (discussed in section 7), the residents thereof can choose to have an air-to-air heat exchanger installed, for which BPA will pay 85 percent of its cost, up to a maximum BPA contribution of \$850. If the heat exchangers are installed and used according to BPA specifications, in most instances the devices will compensate for house tightening by increasing air changes to what they were estimated to be prior to installation of tightening measures.

The decision to let citizens exercise informed choice about their program participation is based on the following factors: (1) Program participants are in a better position to assess their own risks from indoor air pollutants, after receiving information, than are program implementors; (2) individual variability in creating, evaluating, and accepting risk; (3) the continuing uncertainty as to the extent of risk; and (4) BPA's ability to correct for indoor air quality if future studies show greater reason for concern.

The quality of indoor air in any given home is affected by dwelling characteristics and individual activities, as well as pollutant source strengths and emission rates. After being informed about indoor air pollutants and "self-help" measures for controlling them, program participants can assess their own risks of having their health affected by house-tightening, based on their own ways of life and awareness of the characteristics of their homes. This assessment may lead some people to decline tightening measures while others accept them.

The incremental risk may be seen as very serious by some people and negligible by others. The expanded program does not pre-judge the incremental risk by offering tightening measures without informed consent or by restricting the measures to the lower risk homes. The elimination of pre-judgment is appropriate in this instance, because the increment of risk from house tightening is much smaller than the baseline risk of cancer from residential indoor air pollutants. The decision to allow informed choice means that, as a matter of policy, the Administrator defers the judgment of risk to those who potentially face the increased risk. This decision also best meets the needs of both program participants who are willing to accept the risk increment and those who are unwilling.

Other factors which contributed to the decision to allow informed choice included the following: (1) People commenting on the Draft EIS strongly urged that the agency supply information and allow choices, because individual households are in the best position to choose the level of program participation which is most appropriate to their situations. (2) The availability of informed choice will optimize the amount of energy savings from the expanded program. Some of the region's residents chose not to participate at all in the current program because their homes were ineligible for tightening

measures, thus precluding energy savings from non-tightening conservation measures such as ceiling insulation. With informed choice, energy savings can be obtained from those homes where occupants are willing to accept the incremental risk of ill-health. (3) In a society based on democratic principles and individual freedom, people prefer assuming control and responsibility for their own actions, including control of factors affecting their own health. (4) Likewise, BPA has only limited authority to regulate people's actions in their own dwellings.

5. The decision to supply mitigation in the form of information.

This decision, which is a central theme of the expanded weatherization program, requires the communication of information from BPA to those making weatherization decisions and those exposed to the risks resulting from these decisions. For this purpose, information packets will be prepared and distributed to all potential program participants. The packet will describe indoor air pollutants, the effects of house tightening measures on pollutant levels, how residents can recognize the presence of pollutants which can be sensed, the health risks associated with each pollutant, and the "self-help" steps which people can choose to take to control pollutants. The packet will also describe the expanded weatherization program, the availability of radon monitoring at no expense to program participants and the availability of mitigation in the form of air-to-air heat exchangers, on a cost-sharing basis, if monitoring shows that a dwelling exceeds the chosen action level of 5 picoCuries per liter (discussed in section 7).

The decision to supply information is a direct outgrowth of the decision to use informed consent as part of the risk management strategy, instead of conditioning the availability of house tightening measures on BPA's evaluation of health risk increases from tightening.

The following factors entered into the decision to treat information as a form of mitigation. (1) With the exception of radon, information on standard household air pollutants is generally applicable to all situations, but reducing or controlling these pollutants requires specific actions which residents can choose to take (e.g., increasing ventilation when wood stoves are being operated). (2) The agency can neither regulate voluntary actions which increase indoor air pollution, nor require residents to take mitigation steps, however easy, to reduce health risks from these pollutants. (3) Providing information is a simple, inexpensive, and administratively easy means to incorporate risk management into the program. (4) Public comments on the Draft EIS indicated broad support for providing information.

6. The decision to offer monitoring and mitigation for radon.

Under this decision, program participants can choose from a number of options after having had an opportunity to read the information packet described above. The options are: (1) Decline house tightening measures. (2) Accept house tightening measures without radon monitoring. (3) Accept radon monitoring prior to installation of tightening measures; after monitoring results are available, program participants can either decline or accept house tightening measures. If monitoring shows that radon concentrations in a dwelling exceed the action level of 5 picoCuries per liter, residents accepting the house tightening measures will also have the option of having an air-to-air heat exchanger installed as mitigation, for which BPA will pay a large share of the cost. (4) Accept radon monitoring after installation of house tightening and other conservation measures; if monitoring indicates a dwelling exceeds the action level, its occupants can choose to install a partially subsidized air-to-air heat exchanger.

The means chosen for radon monitoring are relatively easy, inobtrusive, and inexpensive. The monitoring device, similar in size to a wrist watch, is attached for 3 to 12 months to a wall or placed on a shelf. Afterward, the device, which is sensitive to radioactive alpha particles, is sent to a laboratory for analysis; the results are then sent to BPA and the program sponsors for distribution to residents who had their homes monitored, along with an interpretation. Monitoring costs of \$36.30 per house will be borne by BPA.

The decision to incorporate radon monitoring and mitigation into the risk management strategy for the expanded weatherization program was based on the following considerations.

(1) Radon exposure, in contrast to other pollutants, is neither detectable through the senses nor affected by human choices, except for the length of time one chooses to be inside a dwelling. The only accurate way to identify homes where health risks from radon exposure exceed acceptable levels is through monitoring.

(2) The monitoring results will enhance residents' abilities to make informed choices about program participation.

(3) The monitoring results, in contrast to other strategies, will allow for a fairly precise matching of homes at high risk from radon with appropriate mitigation. Since radon concentrations vary across homes, mitigation strategies not based on monitoring tend to "over-correct" or "under-correct" for radon exposure. For example, excluding homes without ventilated crawlspaces from tightening may eliminate homes with low radon levels, which really shouldn't be eliminated, from the program. At the same time, allowing homes with

well-ventilated crawlspaces to receive tightening measures may lead to the tightening of homes which, unbeknownst to anyone, have high radon levels.

(4) The incremental risk of ill health from house tightening will be fully mitigated in those homes where air-to-air heat exchangers are installed and used according to BPA specifications. The devices will compensate for house tightening by increasing air changes to what they were estimated to be prior to the installation of conservation measures.

(5) Although the decision to offer radon monitoring and mitigation will increase program costs by somewhere between \$76.6 million and \$130 million, the expanded weatherization program still remains cost effective in comparison to the cost of other resources for satisfying electric energy demand (Pacific Northwest Electric Power Planning and Conservation Act, section 4(e)(1)). Moreover, this approach to risk management, in contrast to other approaches such as excluding certain types of homes, insures that money spent for mitigation will in fact serve the purpose of helping those program participants who are at high risk from radon exposure.

(6) The energy savings of 1.2 average annual megawatts which will be foregone because of air-to-air heat exchanger electric consumption is less than the savings which would be foregone with other approaches to risk management.

(7) Commentors on the Draft EIS who discussed mitigation expressed a preference for monitoring and air-to-air heat exchangers.

7. The decision to adopt an action level of 5 picoCuries per liter for radon mitigation.

BPA is establishing a radon "action level" of 5 picoCuries per liter. Homes which are monitored for radon and found to have concentrations that will exceed this level when tightened will be eligible for financial assistance to help in the purchase of an air-to-air heat exchanger or comparable proven mitigation. In most cases, this will prevent increases in radon concentrations due to house tightening, provided the device is installed and used according to BPA specifications.

Selection of 5 picoCuries per liter (pCi/l) as the action level is based on: (1) a review of proposed standards, guidelines, or recommendations suggested by various agencies or organizations for controlling health hazards associated with airborne radon in residences; (2) an analysis of the regional health effects from radon, the uncertainty surrounding the level of health effects, and the relative accuracy of the proposed monitoring and mitigation strategy; and (3) a review of program economics, including cost of mitigation and estimates of the number of residences which exceed the action level.

By examining these three items, BPA can establish an action level which both provides for the public welfare and allows the agency to pursue its energy conservation goals. This action level balances the estimated health effects against the costs and benefits of weatherization and mitigation.

Several organizations in the U.S.A., and two countries outside the U.S.A., have proposed various guidelines or standards for indoor airborne radon exposure. Several of these guidelines were suggested for the general population and its assumed exposure; some were suggested for specific exposure situations such as occupational or high risk settings. Each was established to provide some measure of acceptable health risk for the exposed population. The various guidelines are outlined in Table 1.

Table 1. Various Guidelines Recommended for Exposure to Radon

<u>Organization</u>	<u>Level</u>	<u>Type of Level</u>
American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)	2 pCi/l	Recommended (for ventilation)
Environmental Protection Agency (EPA)	4 pCi/l	Regulation for U.S. sites contaminated by uranium processing wastes
Environmental Protection Agency (EPA)	4 pCi/l	Recommendation to Governor of Florida for phosphate-reclaimed land - radon in homes
Canadian Atomic Energy Control Board (AECB)	4 pCi/l <u>1/</u>	Regulation non-occupational connected to the operation of a nuclear facility
Canadian Task Force on Radioactivity	3 pCi/l <u>2/</u> (investigate) 7 pCi/l <u>2/</u> (primary action) 50 pCi/l <u>2/</u> (prompt action)	Guideline - non-occupational
Sweden	3.8 pCi/l (new residence) 10.8 pCi/l (refurbished residences) 21.6 pCi/l (existing residences)	Regulation for residential situations
National Council on Radiation Protection and Measurement (NCRP)	8 pCi/l <u>3/</u>	Recommended action level for general population exposure
Mine Safety and Health Administration (MSHA)	16 pCi/l <u>3/</u>	Regulation for miners

1/ Equilibrium factor = 0.5

2/ Equilibrium factor = 0.3 (Canadian recommended equilibrium factor for residences)

3/ Assumed radon gas concentration with equilibrium factor of 0.5 and continuous yearlong exposure

The BPA action level of 5 pCi/l is roughly in the middle of the various non-occupational guidelines established by these organizations. The range of levels is from a low of 2 pCi/l to a high of 50 pCi/l. However, the two highest levels (i.e., 50 pCi/l, and 21.6 pCi/l) are parts of standards which have multiple levels. If the next lowest level (which represents a primary action level for refurbished residences) is used, the range of levels is 2 pCi/l to 10.8 pCi/l. The majority of general population guidelines fall between 4 to 8 pCi/l. BPA, by choosing an action level of 5 pCi/l, is selecting a level which is slightly toward the conservative end of this range. When considering the degree of uncertainty for the estimated health effects predicted in the Final EIS, and the potential inaccuracies of a large-scale monitoring program, the selection of a 5 pCi/l action level over levels of 2 to 4 pCi/l is appropriate. Likewise, a selection of an action level above 5 pCi/l (e.g., 7 to 8 pCi/l) may ignore some potentially significant effects over the long term for occupants of tightened residences.

Estimates in the Final EIS, based on average, "worst-case" assumptions, indicate that if the program were expanded to include tightening for all electrically heated homes which are now ineligible for tightening, the impact from increased radon concentration on the regional lung cancer rate would add 0.31 cancers per 100,000 persons per year to a baseline of 2.5 per 100,000 per year. The range in the increased lung cancer rate would extend from 0.03 to 3.7 per 100,000 persons per year above a baseline range of 1.3 to 9.4 per 100,000 persons per year. These wide ranges indicate the relative uncertainty associated with the regional baseline and health effects estimates.

The regional health estimates were calculated by assuming average radon concentrations in all homes. In contrast, data collected on a limited number of residences in the region under actual conditions indicate that radon concentrations vary greatly, with the majority of residences having low concentrations (e.g., 1 pCi/l) and a few residences having higher than average concentrations (e.g., 5 pCi/l or more). The BPA action level was established at a point which clearly differentiates between the "high radon" residence and the normal residence. Although these few "high radon" residences have a disproportionate share of residential radon concentrations in the region, this is not reflected in the average radon concentrations used to estimate health impacts in the EIS.

Because the risk analysis in the Final EIS is based on average radon concentrations, the increased health risks from house tightening are also spread evenly over all residences. Likewise, the risk reduction from mitigation in a few homes is averaged over all residences expected to participate in the program. Consequently, the risk estimates in the Final EIS convey the impression that mitigation has very little effect on the incremental risk of ill-health from house tightening.

In reality, the few residences with higher radon concentrations have a disproportionate share of the regional risk. Therefore, the purpose of radon monitoring is to identify these few "high radon" residences. Then, by

mitigating these residences, a substantial reduction in overall regional risk is possible, which is not captured by the risk modeling procedures used for estimating health risks in the Final EIS.

The accuracy of the radon monitoring technique also was considered in setting the action level at 5 pCi/l. The accuracy of the radon detector to be used varies according to the length of time it is exposed and the concentration to which it is exposed. If the monitoring time is held constant, the statistical uncertainty of the detector result drops as the concentration increases. For example, a detector exposed for 3 months which measured a concentration of 1.3 pCi/l will have an uncertainty of  $\pm$  50 percent (i.e., the actual concentration is somewhere between 0.65 to 1.95 pCi/l). However, a detector exposed for 3 months which measured 13 pCi/l will have an uncertainty of  $\pm$  20 percent (i.e., the concentration is somewhere between 10.4 and 15.6 pCi/l). For a measured radon concentration of 5 pCi/l (the BPA action level), the uncertainty factor is approximately 30 percent. Thus the actual concentration might be as low as 3.5 pCi/l or as high as 6.5 pCi/l. The low end of this range falls in the middle of the cut off (3-4 pCi/l) between "high radon" residences and normal residences found in a BPA radon study of 270 homes. Therefore, an action level of 5 pCi/l will insure that all "high radon" residences will be identified.

The accuracy of radon monitoring may also be affected because measurements will occur under a variety of conditions. Less accuracy may occur because of errors in detector deployment, disturbances by the residents, or detector handling. It is impossible to predict the effects of these actions on detector results. Since the only goal of the monitoring program is to identify the "high radon" residences, an action level is acceptable which is slightly above the observed breakpoint of 3-4 pCi/l between the many homes which have low radon levels and the few that have high levels.

The costs of the radon monitoring and mitigation strategy also influenced selection of the action level. The purpose of monitoring is to match "high radon" homes with mitigation, rather than offering air-to-air heat exchangers to any or all residences. With the action level set at 5 pCi/l, about 4 to 6 percent of the region's 1.209 million electrically heated homes are expected to exceed it and to be eligible for radon mitigation.

This means that the value of the energy savings to be obtained from all participating residences will offset both the cost of monitoring many of these homes and giving mitigation to a few. Currently available mitigation devices (e.g., air-to-air heat exchangers) are estimated to cost between \$550 and \$1350. Program information and monitoring for each home will cost \$36.30. Assuming the higher cost value for mitigation, the cost of monitoring radon in 1.209 million homes and supplying mitigation devices to 4 to 6 percent

of these homes will increase the total cost of the preferred alternative by about \$85 to \$120 per dwelling, or 0.6 to 1.3 mills per kilowatt-hour. Since the cost of mitigating comparatively few homes is spread over all homes in the program, the program remains cost effective.

The choice of the action level was also based on the energy savings that would be affected. An air-to-air heat exchanger, the current mitigation device, consumes about 10 percent of the energy savings to be realized from house tightening. (This estimate includes both infiltration and thermal effects of measures such as wall insulation and storm windows.) With the action level set at 5 pCi/l, about 1.2 average annual megawatts of energy savings will be foregone for operation of the mitigation devices.

In balancing the various aspects of a risk management strategy that includes radon monitoring and mitigation, the Administrator takes the position that 5 pCi/l is an appropriate action level. A lower action level would increase program costs and reduce energy savings without necessarily obtaining a proportionate reduction in health risks. This is because of the uncertainties associated with monitoring accuracy at lower radon concentration levels and the wide uncertainty range surrounding the health risk estimates.

8. The decision to adopt an 85 percent cost-sharing plan up to a ceiling of \$850 for radon mitigation.

BPA will subsidize the cost of radon mitigation devices by adopting a cost-sharing plan. Under this plan, BPA will pay 85 percent of the cost of purchasing and installing an air-to-air heat exchanger, up to \$850. Only those program participants will be eligible for this subsidy whose homes exceed the action level for radon and who are willing to have house tightening measures installed, either before or after radon monitoring.

The decision to incorporate a cost-sharing plan into the expanded program is premised on the following considerations.

(1) By following radon monitoring with an offer of mitigation where it is warranted, BPA will help residents to reduce a newly identified risk to their health. The Administrator takes the position that since BPA's expanded program will lead to identification of health risks, the agency should also offer risk mitigation.

(2) By partially rather than fully subsidizing mitigation, BPA gives a program participant an incentive to make a conscious decision about having an air-to-air heat exchanger. The effectiveness of this ventilation device to reduce the health risks from house tightening depends on a resident's willingness to operate the equipment according to standard instructions. If a resident chooses to

turn it off, there is no mitigation. BPA takes the position that by requiring payment of a small portion of the mitigation cost, program participants who choose mitigation will be more likely to have a commitment to operating it according to instructions, thereby avoiding health risks from house tightening. Program participants who qualify for the low-income residential weatherization program will receive a 100 percent subsidy, up to \$1000, for mitigation devices.

(3) The cost-sharing plan for mitigation is being set at 85 percent to make it similar to the cost-sharing plan for conservation measures. This will avoid confusion among program participants and make the program easier to administer.

(4) The ceiling of \$850 in the cost-sharing plan was selected on the assumption that for most installations the retail price of the mitigation equipment will not exceed \$1000. The price of the equipment is partly dependent on its size. Larger devices are needed for larger homes. By placing a ceiling on its subsidy, BPA encourages program participants to exert pressure on dealers to maintain competitive prices for mitigation devices.

9. The decision to exclude monitoring and mitigation devices for other pollutants.

BPA will rely only on its information packet to assist program participants in reducing health risks from indoor air pollutants other than radon. The packet describes the steps residents can take to reduce or avoid the health effects from formaldehyde, combustion by-products, and various gases. Neither monitoring nor mitigation will be offered for these pollutants by BPA other than the provision of information for voluntary self-help.

This decision takes into account the capacity of the human senses for detecting different types of pollutants, the ability of program participants to control or avoid exposure to different pollutants, the availability of proven technologies for monitoring and mitigating various pollutants, and the costs of monitoring and mitigation. Because formaldehyde and combustion by-products differ from radon on these matters, BPA has adopted a different approach to the health risks from these pollutants.

Of the various combustion by-products, benzo-a-pyrene is of greatest concern because the health risks of exposure to this carcinogen are comparable to those of exposure to radon. BPA has chosen not to offer monitoring and mitigation, other than information, for benzo-a-pyrene because:

(1) People may sense the presence of combustion by-products without aid of monitoring.

(2) The amount of benzo-a-pyrene present in a home depends almost exclusively on the amount of tobacco smoking and wood stove operation which are voluntary activities.

(3) The results of monitoring for this pollutant will only be valid for a certain level of combustion activity. As soon as a household changes its smoking or wood stove burning habits, the monitoring results would no longer be valid.

(4) The monitoring technology for benzo-a-pyrene is not adequately developed to permit inexpensive, easily administered monitoring on a large scale.

(5) In its present state of development, monitoring would have to be conducted in homes by trained staff using complex equipment, and so constitutes a household intrusion.

In view of these considerations, BPA made the policy judgment that informed choice is the best available means for reducing health risks from increases in benzo-a-pyrene concentrations.

Formaldehyde is also a pollutant of great concern because even at low levels of exposure it can lead to severe allergic reactions in about 10 to 20 percent of the general population. The reactions involve skin, eyes, mucous membranes and the respiratory tract. Nonsensitive individuals can experience eye, nose and throat irritation when exposed to low levels of the chemical. In addition, formaldehyde may be carcinogenic (nasal cancer). Nonetheless, BPA is also relying on informed consent for reducing the health risks from formaldehyde because of the following considerations.

Formaldehyde off-gassing is a transient phenomenon which is influenced by a wide array of interacting variables, including temperature, humidity and the recency of purchases containing formaldehyde. As a result, formaldehyde monitoring is only accurate for the time period in which it occurs, and may not be indicative of the true, long-term situation. Because of the pollutant's transiency, dwellings previously insulated with urea-formaldehyde (UF) foam, a major source of high formaldehyde concentrations, will not present problems. UF foam insulation has virtually disappeared from the market; the unavailability of this product during the past 2 years means that any UF foam insulation existing today will have had sufficient time to off-gas and ventilate thereby reducing formaldehyde concentrations prior to the time of house-tightening. Furthermore, this type of insulation is unlikely to be used in the future because of its effects on health.

In addition, homes built in recent years, which tend to have high formaldehyde concentrations at the outset from newly installed particle board, plywood, furniture, and carpets, will have had time to

off-gas before being tightened. Only those dwellings constructed prior to April 15, 1983, are eligible for inclusion in the expanded weatherization program. By the time house-tightening occurs, these homes are expected to have low formaldehyde concentrations.

Other factors contributing to the decision not to monitor and mitigate for formaldehyde are: (1) excessive concentrations of this gas can be detected through the human senses; (2) residents can take steps on their own to reduce formaldehyde concentrations; and (3) the effectiveness of mitigation devices such as air-to-air heat exchangers in reducing formaldehyde concentration is uncertain; the increased ventilation from these devices may increase the rate of off-gassing in the short run so that reductions in formaldehyde concentrations might not occur.

In balancing the additional cost of \$20 to \$25 million dollars for formaldehyde monitoring and mitigation against such factors as the great individual variability in sensitivity to formaldehyde, the ability of people to help themselves in regard to this pollutant, the difficulty of obtaining valid measurements of a transient phenomenon, and the uncertain efficacy of mitigation, the Administrator concludes that the beneficial results of formaldehyde monitoring and mitigation would be too few and uncertain to merit the costs thereof.

Other indoor air pollutants, which include gases such as carbon monoxide, carbon dioxide and oxides of nitrogen, and respirable suspended particles dissipate quickly and are thought to cause mainly chronic health effects such as nose and throat irritation. Since there is no simple monitoring technology yet available for these pollutants, monitoring would be expensive and difficult to administer, and would require trained staff to perform monitoring in people's homes. In weighing these various factors, the Administrator concludes that monitoring and mitigation are also not warranted for these pollutants.

10. The decision not to adopt the environmentally preferred alternative

The environmentally preferred alternative would allow for provision of air-to-air heat exchangers to all homes in which tightening measures are installed, thereby virtually eliminating the increment of risk of ill-health from house-tightening.

The Administrator determines that the almost complete avoidance of health effects from the environmentally preferred alternative is not a sufficient reason for choosing this course of action in light of the following considerations.



(1) If many larger-sized air-to-air-heat exchangers need to be installed, this alternative would increase costs to the point where the expanded program would no longer be cost effective.

(2) This alternative would mitigate health effects from the program in homes that are at low risk as well as in those at high risk since there is no provision for identifying high risk homes; to supply mitigation where it is not needed is not an appropriate use of agency funds.

(3) Approximately 18.3 average annual megawatts of energy savings would be foregone under this alternative; if a generating plant were built sooner to compensate for the energy savings not obtained, there would be adverse effects on land and water resources.

(4) This alternative would limit freedom of choice and intrude on privacy by requiring all program participants to take an air-to-air heat exchanger along with tightening measures. Since program participants would not be given an opportunity to choose mitigation and make a commitment to it, the likelihood is increased that some participants may choose not to operate the device, including those who may be at high risk from radon without knowing it.

(5) The public comments received on the Draft EIS gave virtually no support to mitigation for all homes participating in the program.

FOR FURTHER INFORMATION CONTACT: For information and for additional copies of the Record of Decision or the Final Environmental Impact Statement, contact Anthony Morrell, Environmental Manager, BPA, P.O. Box 3621 - SJ, Portland, Oregon 97208; (503) 230-5136.

Issued in Portland, Oregon, September 25, 1984.

James J. Jura  
Acting Administrator